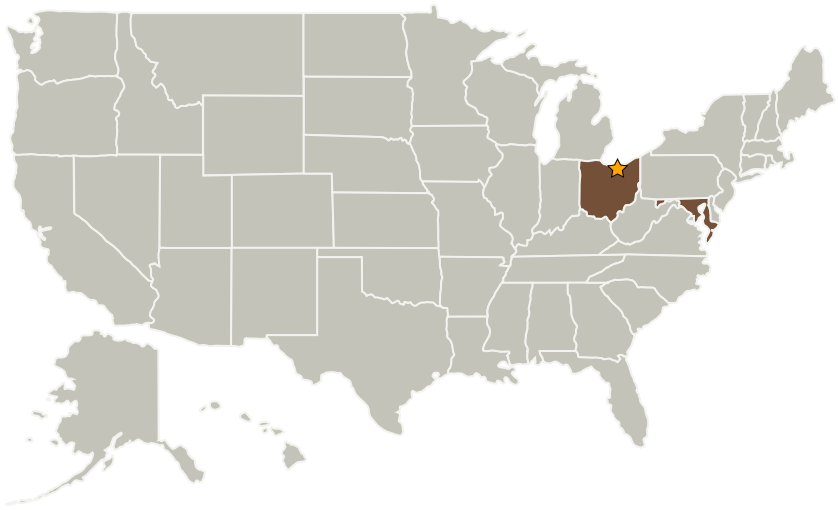
Passive Capillary Pumped Cryocooling System for Zero-Boil-Off Cryogen Storage Tanks, Phase I

Completed Technology Project (2006 - 2006)

Project Introduction

Significant cost and weight savings of a space mission can be achieved by improving the cryogenic storage technology. Added cryogen mass due to the cryogen boil-off, the oversized tanks and storage systems make the planetary missions prohibitive. The recently proposed Zero-Boil-Off (ZBO) strategy for cryogen tanks, which combines both thermal insulation and "cryocooling" technologies to manage the heat leaks. It is a straightforward concept that could lead to a significant weight/cost reduction for long-duration missions. However, several issues must be resolved before the ZBO benefits can be realized. One of which is the management of the through-the-tank-wall "heat leaks". Loop Heat Pipe (LHP) is a passive two-phase heat transport device that utilizes solely capillary action to circulate the working fluid in a closed loop to transfer heat from one location to another. LHPs do not contain mechanical moving parts and therefore are highly reliable and durable for space applications. A novel cryogenic LHP system is proposed for the ZBO cryocooling. It is capable of acquiring heat from a large area of the cryo-tank wall, transporting it to a cryocooler for heat rejection, and meeting other design requirements of cryogen storage systems for space missions.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
TTH Research, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Laurel, Maryland

Primary U.S. Work Locations	
Maryland	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.1 In-space Propellant Storage & Utilization